SIEMENS

PATENT
Attorney Docket No. 2003P07614US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Inventor:	R. Ruka et al.	Group Art Unit:	1745
Serial No.:	10/663,949	Examiner:	K. Walker
Filed:	September 16, 2003		

Title: PLASMA SPRAYED CERAMIC-METAL FUEL ELECTRODE

Commissioner For Patents
PO BOX 1450
Alexandria, VA. 222313-1450

Sir:

APPELLANTS BRIEF

This Appeal Brief relates to an appeal from the sixth rejection of claims 1-18 in the Office Action mailed November 13, 2007 and after the Board reversed all seven of the Examiner's prior rejections of the pending claims.

Real Party in Interest

This application is assigned to Siemens Power Generation, Inc. (f/k/a Siemens Westinghouse Power Corporation), a Delaware corporation having a principle place of business in Orlando, Florida. Siemens Power Generation, Inc, is a wholly owned subsidiary of Siemens Corporation of Iselin, New Jersey.

Related Appeals and Interferences

Applicants previously appealed the Examiner's seven rejections of the pending claims and on October 31, 2007 the Board reversed all seven of the Examiner's rejections. There are no other prior and pending appeals, interferences or judicial proceedings known to Applicants, Applicants' legal representative, or Assignee which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

Status of Claims

Claims 1-18 stand rejected for the sixth time by the Office Action mailed November 11, 2007 and are presently under appeal in this proceeding. Claims 19-22 stand withdrawn from consideration for being drawn to a non-elected group. Applicants do not appeal the rejection of claims 1-4 and 16-17; this appeal only concerns claims 5-15 and 18.

Status of Amendments

No amendment has been filed subsequent to the Office Action mailed November 11, 2007.

Summary of Claimed Subject Matter

Independent Claim 1

Referring to Figure 2, independent claim 1 recites a tubular solid oxide fuel cell 10, comprising:

an air electrode 14 (see e.g. page 8 line 5 - page 9 line 2);

an electrolyte 16 formed on at least a portion of the air electrode 14 (see e.g. page 9 lines 3-21); and

a ceramic-metal fuel electrode 18 having a microstructure characterized by accumulated molten particle splats formed on at least a portion of the electrolyte (see e.g. page 9 line 21 – page 10 line 17, page 15 lines 13-16).

Dependent Claim 4

Referring to Figure 2, dependent claim 4 recites that the fuel electrode comprises nickel and zirconia (see e.g. page 15 lines 6-9).

Dependent Claim 5

Referring to Figure 2, dependent claim 5 recites that the fuel electrode comprises at least 60% nickel and at least 15% zirconia (see e.g. page 15 lines 6-9).

Dependent Claim 6

Referring to Figure 2, dependent claim 6 recites that the fuel electrode comprises at least 70% nickel and at least 20% zirconia (see e.g. page 15 lines 6-9).

Dependent Claim 7

Referring to Figure 2, dependent claim 7 recites that the fuel electrode comprises no more than 85% nickel and no more than 40% zirconia (see e.g. page 15 lines 6-9).

Dependent Claim 8

Referring to Figure 2, dependent claim 8 recites that the fuel electrode comprises no more than 80% nickel and no more than 30% zirconia (see e.g. page 15 lines 6-9).

Dependent Claim 9

Referring to Figure 2, dependent claim 9 recites that a nickel graphite powder is used to obtain at least a portion of the nickel (see e.g. page 13 line 20 - page 14 line 16).

Dependent Claim 10

Referring to Figure 2, dependent claim 10 recites that the nickel graphite powder comprises at least 60% nickel and at least 15% graphite (see e.g. page 13 line 20 - page 14 line 16).

Dependent Claim 11

Referring to Figure 2, dependent claim 11 recites that the nickel graphite powder comprises at least 70% nickel and at least 20% graphite (see e.g. page 13 line 20 - page 14 line 16).

Dependent Claim 12

Referring to Figure 2, dependent claim 12 recites that a yttria stabilized zirconia powder is used to obtain at least a portion of the zirconia (see e.g. page 14 lines 17 - 23).

Dependent Claim 13

Referring to Figure 2, dependent claim 13 recites the yttria stabilized zirconia powder comprises at least 7 mole percent of yttria (see e.g. page 14 lines 17-23).

Dependent Claim 14

Referring to Figure 2, dependent claim 13 recites the yttria stabilized zirconia powder comprises at least 8 mole percent of yttria (see e.g. page 14 lines 17-23).

Dependent Claim 15

Referring to Figure 2, dependent claim 15 recites the electrolyte 16 comprises a rare-earth element stabilized zirconia (see e.g. page 9 lines 14-17).

Dependent Claim 18

Referring to Figures 2 and 4, dependent claim 18 recites a precursor layer 30 formed between the electrolyte 16 and the fuel electrode 18 (see e.g. page 16 line 15- page 17 line 8).

Grounds for Rejection to be Reviewed

(1) Whether claims 1-4, 9-12 and 15-17 are unpatentable under 35 U.S.C. § 102(b) as being anticipated by Tsukuda (Application of Plasma Spraying to Tubular-Type Solid Oxide Fuel Cells Products).

(2) Whether claims 1-4, 9-12 and 15-17 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Tsukuda in view of what would have been obvious to one skilled in the art.

(3) Whether claims 1-18 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Cable (USPN 5,589,285) in view of Applicants admitted prior art.

(4) Whether claims 1-18 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Cable in view of Tsukuda.

(5) Whether claims 5-8 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Tsukuda in view of what would have been obvious to one skilled in the art.

(6) Whether claims 5-8 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Tsukuda in view of Jensen (USPN 5,035,962).

(7) Whether claims 9-11 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Tsukuda in view of Clemmer further in view of INCO, Ltd.

(8) Whether claim 18 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Tsukuda in view of Cable.

Appellants' Argument

(1) Claims 1-4, 9-12 and 15-17 stand rejected under 35 U.S.C. § 102(b), the Examiner contending that these claims are anticipated by Tsukuda.

Applicants do not dispute the rejection of claims 1-4.

Claim 9 recites that a nickel graphite powder is used to obtain at least a portion of the nickel element of the fuel electrode. Claims 10 and 11 respectively recite that the nickel graphite powder comprises at least 60% nickel and at least 15% graphite and at least 70% nickel and at least 20% graphite.

The Examiner's sixth rejection of claims 9-11 is based on a brand new interpretation of claims 9-11, never previously set forth during the prior five office actions. The Examiner now contends that claims 9-11 are product-by-process claims because the graphite portion of the claimed nickel graphite powder does not remain part of the fuel electrode (it is burned off during sintering) and thus it is not necessary to find prior art that discloses or suggests the otherwise distinguishing nickel graphite powder limitations. The Examiner ignores the fact that the nickel portion of the claimed graphite powder forms the nickel element of the fuel electrode.

Claims 9-11 are product claims, not product-by-process claims. Support for this is found in the renowned patent treatise *Landis on Claim Drafting* and case law.

> A product-by-process claim is one where an article or at least one element of an article is claimed by reciting the process for fabricating the article or its element. Typically, the article or element is recited in the form of a method claims or a method limitation, preferably using the gerund from for the process step in which the product or its element is formed. The simplest form of such a claim might be: 5C. Sodium hydroxide produced according to the process of claim 5B.

Robert C. Faber, *Landis on Mechanics of Patent Claim Drafting*, § 46. Landis § 46 then analyzes case law to support the proposition that claim terms which recite the structural end state of some transformational activity (rather than the transforming activity itself) are properly considered product claims. Thus, since the term "nickel graphite powder" recites the structural end of the nickel portion of the fuel electrode, it is properly held as structure - not process. To somehow interpret nickel graphite powder as process simply because "the final product taught claimed does not include the graphite" as the Examiner does, is irrelevant to the product-by-process determination and improper. Therefore the rejection fails.

Claim 12 recites that a yttria stabilized zirconia powder is used to obtain at least a portion of the zirconia element of the electrolyte. The Examiner ignores this limitation and does not even contend that it is a product-by-process limitation. MPEP 2131 states that "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly, inherently described, in a single prior art reference" The Examiner has failed to meet this burden. Therefore the rejection fails.

Claim 15 recites that the electrolyte comprises a rare-earth element stabilized zirconia. The Examiner ignores this limitation. In fact, p. 365 table 1 of Tsudaka discloses that the electrolyte composition is yttria stabilized zirconia. Yttria is not a rare-earth element. See e.g. Rare Earth Periodic Table, www.chemicalelements.com/groups/rareearth.html. Therefore the rejection fails.

Applicants do not dispute the rejection of claims 16-17.

(2) Claims 1-4, 9-12 and 15-17 stand rejected under 35 U.S.C. § 103(a) as being obvious over Tsukuda in view of what would have been obvious to one skilled in the art.

Applicants do not dispute the rejection of claims 1-4.

The Examiner does not contend that Tsukuda suggests the claimed nickel graphite powder limitations (claims 9-11). As discussed above in connection with the Section 102 rejection, the Examiner erroneously contends that the nickel graphite powder limitation has no

patentable weight because it is a product-by-process limitation. The Examiner simply ignores the yttria stabilized zirconia powder limitation (claim 12) and the rare-earth element stabilized zirconia limitation (claim 15). MPEP 2143 states "the prior art references (or the references when combined) must teach or suggest all the claim limitations." The Examiner has failed to meet this burden. Therefore the rejection fails.

Applicants do not dispute the rejection of claims 16-17.

(3) Claims 1-18 stand rejected under 35 U.S.C. § 103(a), the Examiner contending that these claims are obvious over Cable in view of Applicants admitted prior art.

In the earlier appeal, The Board reversed the Examiner on this rejection (Cable in view of what would have been obvious to one skilled in the art). Applicants respectfully request the Examiner to withdraw the rejection since the Board previously reversed the Examiner.

In making this "new" rejection, the Examiner contends that it would be obvious: (1) "to use a different method of applying the fuel electrode, as discussed by Cable" because (2) "Applicant admitted prior art teaches it is well known in the art to apply the fuel electrode using the plasma spray technique." The Examiner's contention is badly misplaced for two reasons: (1) Cable does not discuss using a different method of applying the fuel electrode. In fact, Cable provides no such discussion and Applicants respectfully request the Examiner to cite where Cable supposedly provides this discussion. (2) Applicants never made the admission that the Examiner claims they made. To the contrary, page 4 lines 6-14 of Applicants' specification explains:

> Use of such plasma spraying techniques have been of limited value when used to apply a fuel electrode onto an electrolyte because they tend to result in a fuel electrode that poorly adheres to the electrolyte and exhibits poor thermal cyclability due to the mismatch of thermal coefficients of expansion between the metal portion of the fuel electrode and the ceramic electrolyte. Moreover, conventional plasma spraying techniques tend to result in a fuel electrode that has a low porosity after continued use, thereby causing voltage loss when current flows as a result of polarization

> due to a low rate of diffusion of fuel gasses into and reaction product out from the interface between the fuel electrode and the electrolyte.

Curiously, the Examiner cites "Pgs. 3 & 4 of instant specification" for the polar opposite contention. Applicants respectfully request the Examiner to more precisely explain what, where and how Applicants supposedly admitted the polar opposite of what they disclosed on page 4 of their specification.

Regarding claims 9-11, Applicants also restate their earlier arguments that these claims are properly product claims and not product-by-process claims. Regarding claims 12 and 15, Applicants also restate their earlier arguments that limitations exists that the Examiner has improperly ignored.

As Applicants successfully argued in the first appeal, Cable does not teach or suggest a tubular fuel electrode having a microstructure characterized by accumulated molten particle splats (which would be caused by plasma spraying), as contended by the Examiner. Rather, Cable 8:30-35 teaches that a very thin fuel electrode interfacial layer 19, not the fuel electrode 4 may be formed by other techniques such as plasma deposition, spin casting, spraying or screen printing. Cable also goes into significant detail teaching away and distinguishing its planar fuel cell design from the claimed tubular fuel cell design, explaining that its invention is directed to fuel cells which are tolerant of sulfur-bearing fuels (1:15-17) and that tubular fuel cells are intolerant of sulfur bearing fuels (1:25-30, 1:55-2:59). It is impermissible to "pick and choose from any one reference only so much as will support a given position to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one skilled in the art". Bausch & Lomb v. Barnes-Hind/Hydrocurve, 230 USPQ 416, 419 (Fed. Cir. 1986). It is error for the Examiner to simply ignore that Cable explicitly teaches that its disclosure is incompatible with Tsukuda's fuel cells.

(4) Claims 1-18 stand rejected under 35 U.S.C. § 103(a), the Examiner contending that these claims are obvious over Cable in view of Tsukuda.

The Examiner's motivation argument is based on the contention that Tsukuda teaches that its plasma spraying improves the adhesion between each of the components of the fuel cell, citing Pg. 365, second column, and "therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the fuel electrode application technique of Cable with the plasma spraying technique of Tsukuda to improve the adhesion between components." The Examiner's contention is badly misplaced. In fact, the cited portion of Tsukuda explains that the plasma spraying results in "Each of the components is adequately formed on the support tube, and the adhesion between them is reliable." "Reliable" is markedly different than "improved". As Applicants explained in their Background of the Invention section of the specification "plasma spraying techniques have been of limited value when used to apply a fuel electrode onto an electrolyte because they tend to result in a fuel electrode that poorly adheres to the electrolyte and exhibits poor thermal cyclicability due to the mismatch of thermal coefficients of expansion between the metal portion of the fuel electrode and the ceramic electrolyte." Page 4 lines 6-10. Thus, at most, Tusukada teaches that its plasma spraying is sufficiently reliable so as not to cause fuel cell adhesion failure, and clearly provides no motivation to swap Cable's adhesion superior deposition technique with its less than adhesion superior deposition technique.

Applicants also restate their earlier argument that Cable itself goes into great detail teaching away and distinguishing its planar fuel cell design from Applicants' claimed tubular fuel cell design, explaining that its invention is directed to fuel cells which are tolerant of sulfur-bearing fuels (1:15-17) and that tubular fuel cells are intolerant of sulfur bearing fuels (1:25-30, 1:55-2:59). It is error for the Examiner to "pick and choose" selected portions of Cable that support his position while ignoring the portions of that Cable explicitly teaches that its disclosure is incompatible with Tsukuda's fuel cells.

(5) Dependent claims 5-8 stand rejected under 35 U.S.C. § 103(a), the Examiner contending that these dependent claims are obvious over Tsukuda in view of what would have been obvious to one skilled in the art.

The Examiner's obvious results-effective variable argument is based on the contention that "it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the nickel-zirconia mixing ratio to optimize the conductivity and coefficient of thermal expansion, since it is held that discovering an optimum value of a result effective variable involves on routine skill in the art."

MPEP 2144.05IIB states "A particular parameter must first be recognized as a result-effective variable, i.e. a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation." The Examiner has not met the burden of showing that the nickel and zirconia percentage limitations are recognized as results-effective variables. At most, the Examiner cites to Figure 7 of Tsukuda and contends "this graph shows that varying the metal and ceramic mixtures, an optimum resistance for the material can be obtained." Applicants respectfully disagree and submit that Figure 7 speaks for itself and states "effect of mixing ratio of Al_2O_3 on resistivity of Ni-alloy-sprayed coating." Al_2O_3 is completely irrelevant to claims 5-15 and thus Figure 7 does nothing to evidence the Examiner's contention that the limitations of claims 5-15 are recognized as results-effective variables. Therefore, the rejection fails.

MPEP 2144.05IIB states that an optimization as obvious rejection "may also be rebutted by showing that the art, in any material respect, teaches away from the claimed invention." In fact, Cable also goes into significant detail teaching away and distinguishing its planar fuel cell design from Applicants' claimed tubular fuel cell design, explaining that its invention is directed to fuel cells which are tolerant of sulfur-bearing fuels (1:15-17) and that tubular fuel cells are intolerant of sulfur bearing fuels (1:25-30, 1:55-2:59). Thus, Cable clearly and specifically teaches away from Applicants' claimed tubular fuel cell invention. Therefore, the rejection fails.

(6) Dependent claims 5-8 stand rejected under 35 U.S.C. § 103(a), the Examiner contending that these dependent claims are obvious over Tsukuda in view of Jensen (USPN 5,035,962).

The Examiner's obvious argument is based on the contention that "it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to have used the fuel electrode compositions as taught by Jenson in the fuel cell as taught by Tsukuda to meet the simultaneous requirements of adhesion of the yttria stabilized zirconia electrolyte and adequate electrode conductivity."

Jenson (who invented and assigned his invention while employed by Applicants' employer Siemens Power Generation, Inc.) teaches a very different fuel electrode fabrication technique than Tsukuda or Applicants invention. Jenson involves fabricating the fuel electrode via a sintering process that can be successful if graded from being high in zirconia at the interface between the electrode and the electrolyte to being high in nickel at the external surface of the electrode, which is necessary for the sintering process to meet the simultaneous requirements of adhesion of the yttria stabilized zirconia electrolyte and adequate electrode conductivity. Col. 2 lines 37-68. Importantly, as page 3 lines 10-15 of Applicants specification explains:

> In an effort to reduce fuel electrode manufacturing cost, sintering processes have been attempted, such as those described in U.S. Patent Nos. 4,971,830, 5,035,962 [Jenson], 5,908,713 and 6,248,468. However, fuel electrodes applied by a sintering process are relatively time consuming in that it still requires at least two processing steps, an initial application followed by high temperature sintering. Moreover, sintered fuel electrodes may experience marginal physical stability over time.

Thus, if one skilled in the art was to actually combine Jenson with Tsukuda as the Examiner contends, Applicants respectfully submit that the result would be a fuel electrode applied by a graded sintering process. It is impermissible to "pick and choose from any one reference only so much as will support a given position to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one skilled in the art" Bausch & Lomb v. Barnes-Hind/Hydrocurve, 230 USPQ 416, 419 (Fed. Cir. 1986).

Moreover, the Examiner's internal arguments are logically flawed and confusing; that is, his rejection (4) above, contends that one skilled in the art would be motivated to replace Cable's colloidal fabrication technique with Tsukuda's plasma spraying technique because plasma spraying improves adhesion (which Applicants disagree) yet now, he argues that the same skilled artisan would be motivated to replace Tsukuda's plasma spraying technique with Jenson's graded sintering technique because graded sintering improves adhesion. Applicants respectfully submit that this illogical logic exemplifies how the Examiner has succumbed to the insidious temptation of hindsight to conclude that the inventive features taught by Applicants are merely obvious design considerations. As explained by the Federal Circuit:

> Virtually all inventions are combinations of old elements. Therefore an examiner may often find every element of a claimed invention in the prior art. If identification of each claimed element in the prior art were sufficient to negate patentability, very few patents would ever issue. Furthermore, rejecting patents solely by finding prior art corollaries for the claimed elements would permit an examiner to use the claimed invention itself as a blueprint for piecing together elements in the prior art to defeat the patentability of the claimed invention. Such an approach would be an illogical and inappropriate process by which to determine patentability.

In re Rouffet, 47 U.S.P.Q.2d 1453, 1457 (Fed. Cir. 1998).

Regarding claims 6 and 8, the Examiner also contends that Jenson's continuously graded fuel electrode has weight percents according to his calculations on page 9 of the office action. However, assuming arguendo that the Examiner's calculations are correct, this results in a fuel electrode that has 45.3% – 65.4% nickel and 34.5% – 54.6% zirconia (taking 1/3 the respective weights of each of the 3 layers). This range does not cover the limitations of claim 6 (at least 70% nickel and at least 20% zirconia) or claim 8 (no more than 80% nickel and no more than 30% zirconia). Therefore, the rejection with respect to claims 6 and 8 must fail.

(7) Dependent claims 9-11 stand rejected under 35 U.S.C. § 103(a), the Examiner contending that these dependent claims are obvious over Tsukuda in view of Clemmer further in view of INCO, Ltd website (www.incosp.com).

Claims 10 and 11 recite that the nickel graphite powder comprises at least 60% nickel and at least 15% graphite and at least 70% nickel and at least 20% graphite.

The Examiner contends that Clemmer teaches using 55% nickel content and that it would have been obvious to increase the nickel percentage to 60 or 75% because: (1) these higher nickel percentages are commercially available from INCO and (2) Clemmer explains that "the anodes created from the Ni-coated graphite particles had a lower coefficient of thermal expansion and higher electrical conductivity for a given Ni loading compared to the anodes made of separate Ni and graphite particles".

Regarding (1), Applicants respectfully submit that just because nickel graphite powder is made with various nickel content that in of itself does not make it obvious to modify the nickel content in the nickel graphite powder. Applicants request the Examiner to clarify this rationale. Regarding (2), Applicants respectfully submit that this portion of Clemmer clearly teaches making the fuel electrodes from Ni-coated graphite particles rather than separate Ni and graphite particles, which is irrelevant to increasing the percentage of nickel within the nickel graphite powder.

(8) Dependent claim 18 stands rejected under 35 U.S.C. § 103(a), the Examiner contending that these dependent claims are obvious over Tsukuda in view of in view of Cable.

Applicants restate their earlier argument that Cable itself goes into great detail teaching away and distinguishing its planar fuel cell design from Applicants' claimed tubular fuel cell design, explaining that its invention is directed to fuel cells which are tolerant of sulfur-bearing fuels (1:15-17) and that tubular fuel cells are intolerant of sulfur bearing fuels (1:25-30, 1:55-2:59). It is error for the Examiner to "pick and choose" selected portions of Cable that support his position while ignoring the portions of that Cable explicitly teaches that its disclosure is incompatible with Tsukuda's fuel cells.

Conclusion

For the foregoing reasons, Applicants respectfully submit that the rejections set forth in the final Office Action are inapplicable to the pending claims. The honorable Board is therefore respectfully requested to reverse the final rejection of the Examiner and to remand the application to the Examiner with instructions to allow the pending claims. Please grant any extensions of time required to enter this paper. Please charge any appropriate fees due in connection with this paper or credit any overpayments to Deposit Account No. 19-2179.

Respectfully submitted,

Dated: 2/13/08

By: _____

John P. Musone
Registration No. 44,961
(407) 736-6449

Siemens Corporation
Intellectual Property Department
170 Wood Avenue South
Iselin, New Jersey 08830

Claims Appendix

1. A tubular solid oxide fuel cell, comprising:

an air electrode;

an electrolyte formed on at least a portion of the air electrode; and

a ceramic-metal fuel electrode having a microstructure characterized by accumulated molten particle splats formed on at least a portion of the electrolyte.

2. The fuel cell of claim 1, wherein the air electrode composition comprises lanthanum manganite.

3. The fuel cell of claim 1, wherein the electrolyte composition comprises yttria-stabilized zirconia.

4. The fuel cell of claim 1, wherein the ceramic-metal fuel electrode composition comprises nickel and zirconia.

5. The fuel cell of claim 4, wherein the fuel electrode composition comprises at least 60% nickel and at least 15% zirconia.

6. The fuel cell of claim 5, wherein the fuel electrode composition comprises at least 70% nickel and at least 20% zirconia.

7. The fuel cell of claim 4, wherein the fuel electrode composition comprises no more than 85% nickel and no more than 40% zirconia.

8. The fuel cell of claim 7, wherein the fuel electrode composition comprises no more than 80% nickel and no more than 30% zirconia.

9. The fuel cell of claim 4, wherein a nickel graphite powder is used to obtain at least a portion of the nickel.

10. The fuel cell of claim 9, wherein the nickel graphite powder comprises at least 60% nickel and at least 15% graphite.

11. The fuel cell of claim 10, wherein the nickel graphite powder comprises at least 70% nickel and at least 20% graphite.

12. The fuel cell of claim 4, wherein a yttria stabilized zirconia powder is used to obtain at least a portion of the zirconia.

13. The fuel cell of claim 12, wherein the yttria stabilized zirconia powder comprises at least 7 mole percent of yttria.

14. The fuel cell of claim 13, wherein the yttria stabilized zirconia powder comprises at least 8 mole percent of yttria.

15. The fuel cell of claim 1, wherein the electrolyte composition comprises a solid oxide comprising a rare-earth element stabilized zirconia.

16. The fuel cell of claim 1, wherein the tubular solid oxide fuel cell further comprises an interconnect that interconnects a plurality of tubular solid oxide fuel cells.

17. The fuel cell of claim 16, wherein the interconnected tubular solid oxide fuel cells form a power generation system.

18. The fuel cell of claim 1, wherein the fuel cell further comprises a precursor layer formed between the electrolyte and the fuel electrode, the precursor layer composition comprising zirconia and having a thickness of about 5 um to about 20 um.

19. (withdrawn) A method of manufacturing a fuel cell, comprising:

providing an air electrode;

arranging an electrolyte adjacent the air electrode; and

plasma spraying a ceramic-metal fuel electrode powder onto at least a portion of the electrolyte with a plasma spray gun.

20. (withdrawn) The method of claim 17, wherein the powder has a gun feed rate of about 6 grams per minute to about 30 grams per minute, and a distance of about less than 4 inches between the gun and the electrolyte.

21. (withdrawn) The method of claim 17, wherein the spray gun has a discharge voltage of about 30-60 volts, a current of about 400-900 amperes, and a power of about 10-40 kilowatts.

22. (withdrawn) The method of claim 19, wherein the spray gun moves at a rate of about 400 mm/sec to about 700 mm/sec and the electrolyte makes about 2-40 revolutions around the spray gun to form the fuel electrode.

Evidence Appendix

None

Related Proceedings Appendix

A copy of the Board's October 31, 2007 reversal of all seven of the Examiner's prior rejections of the pending claims attached hereto - Appeal 2007-4240.